JUNIOR HIGH SCHOOL CURRICULUM GUIDE FOR INDUSTRIAL ARTS

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Introduction

Industrial education in Canada has gone through a period of rapid change. In Alberta this change has resulted in a critical examination of the industrial arts program, culminating in a revised course designed to meet the needs of students who must become aware of a highly technological society.

Some of the major developments which are having an impact on the educational environment are: (1) Increased industrialization and technological developments which have produced changes in both the occupational classifications in Alberta and requirements for entrance into occupations; (2) Increased mobility of the population in Alberta and Canada which has resulted in attempts to equalize educational opportunities in rural and urban centers; and (3) Increased and more diversified student population currently in secondary schools.

The establishment of vocational education facilities in the Province of Alberta has provided an impetus for curriculum committees to examine the content of subject areas in the secondary schools. Prior to the establishment of the new vocational education facilities, industrial arts in Alberta performed a dual function: that of contributing to general education in the junior and early senior high school program, and that of providing vocational education in the final years of the senior high school program. This dual function is no longer necessary; it is certainly not desirable.

The committee responsible for outlining the industrial arts program which follows has kept these facts in mind. The committee considered it important to examine the literature on industrial arts education. The quotations which follow have been selected to illustrate some of the major statements of purpose of industrial arts.

Contemporary Thought in Industrial Arts Education

Frederick Bonsor and Lois Mossman indicated the purpose of industrial arts when they formulated a definition of this subject area nearly forty years ago. Their definition has been the most widely quoted one in the history of industrial arts.

> "The industrial arts are those occupations by which changes are made in the forms of materials to increase their values for human usage. As a subject for educative purposes, industrial arts is a study of the changes made by man in the forms of materials to increase their values, and of the problems of life related to these changes."[1]

1. F. Bonsor and L. Mossman, Industrial Arts for Elementary Schools, 1924, Macmillan Co., New York. pp. 3-18.

In 1957, Hornbake made the following statement:

"The acceptance of industrial arts into the family of school disciplines assumes that the world of work, particularly the phenomena of industry, constitutes a legitimate area of study. Can a person who lives in an industrial democracy law claim to being an educated person if he has not become aware of the basic processes by which society maintains itself."[2]

Hostetler and Young, Professors of industrial arts at North Carolina State College stated:

"If we over simplify the total task of education and agree that the central purpose of education is to enable the student to solve all of his problems (emotional, social, communicative, vocational, etc.) we would then say that the purpose of industrial arts is to provide experiences which will enable the student to solve the technical problems of living in a highly industrial age. The experiences provided should give the student an opportunity to apply science, mathematics, and other facets of his general education to the solution of practical problems in the industrial arts shop. Industrial arts is the general education aspect of the industrial education complex. It is general education in that it is not specialized. These experiences are not those which prepare for a trade or vocation, but are designed to familiarize the student not only with materials, processes, and tools of industry but also with industry as science and invention - as a means of producing goods and services - and as a unique pattern of human relationships. Industrial arts is designed to provide general orientation and basic skills and experiences which may become a basis for making vocational decisions and for further study in the industrial-technical complex." [3]

Feirer, editor of the Industrial Arts and Vocational Education Magazine, made the following statements with regard to the purpose of industrial arts:

"A good industrial arts program affords students an insight into American Industry, the source of raw materials, how basic materials are processed, how products are designed and produced, and how people earn a living."

2. L. Hornbake, "Philosophical Viewpoints", American Council on Industrial Arts Teacher Education, A Sourcebook of Readings on Education. 6th Yearbook, (Bloomington, Illinois: McKnight & McKnight Publishing Co., 1957), pp. 14-15.

3. I. Hostetler and T. B. Young, A Guide to Curriculum Study - Industrial Arts. (Raleigh, North Carolina: State Board of Education, 1959), p. 3.

A summary of the few statements quoted above and of industrial arts literature in general illustrates that there appears to be consensus on the following points:

(a) Industrial arts education is a part of general education.

(b) Industrial arts education is concerned with interpreting the world of work with industry a salient component, to all youth.

Functional Objectives of Secondary Education

It is important that instructors of industrial arts visualize their role as a part of general education. To facilitate this the functional objectives of secondary education in the Province of Alberta are included below.

1. Personal Development

The prime aim of the school is to assist each Alberta youth in his growth towards maximum self-realization. Definite goals of physical fitness, mental health, and intellectual achievement are included under this heading.

(a) ability to think rationally, to express thought clearly and to read and listen with understanding.
(b) a broad understanding of the methods of science, its major findings and its influence on human affairs.
(c) a broad understanding of the fundamental principles of mathematics and their importance in daily living; a mastery of mathematical skills necessary for vocational competence.
(d) an understanding and appreciation of cultural heritage.
(e) the development of suitable recreational and leisure-time activities.
(f) the development of character manifested in sound habits of behavior in social relationships.
(g) the development of a pattern of values, attitudes, and ethical ideals which generalize and furnish justification for good habits and culminate in a philosophy of life which recognizes the importance of religion.

2. Growth in Family Living

Each Alberta youth must learn to appreciate the unique and indispensable place in society played by the home and family with specific attention to the influence of the family unit upon right thinking in connection with morals, institutions, and the current issues of democratic living. The school should assist him to achieve a better understanding and appreciation of:

(a) The responsibilities and privileges of the members of the family group.
(b) The home as a democratic institution.
(c) The conditions essential to successful family life.
(d) The opportunities for enjoyment at home.
(e) The functions and responsibilities of parents.
(f) The relationship of the family to its neighbors and the community.

3. Growth Toward Competence in Citizenship

Each Alberta youth must be brought gradually to a realization of his position and responsibilities in the school, community, province, nation, and finally in the community of nations. The school should guide him in:

(a) Acquiring insight into the historical background of contemporary society.
(b) Developing competence in meeting, and attempting to solve, public problems and issues which citizens are required to encounter and on which they must take action.
(c) Developing competence in political action at the school, community, national, and world levels.
(d) Developing consumer competence.
(e) Developing democratic attitudes and behavior in all social situations.
(f) Establishing loyalty to the ideals of democracy and acquiring an appreciation of his community, the province and the nation.

4. Occupational Preparation

The school must help each Alberta youth to develop those understandings and attitudes that will make him an intelligent and productive participant in economic life; and assist him to develop saleable skills, or prepare him for post-school vocational training. The youth should:

"(a) Become familiar with the range of vocational opportunities open to him.
(b) Learn how to take full advantage of the school and extra-school guidance services.
(c) Achieve an acceptance of his own capacities as indicated by professional analysis of interests, socio-economic status, aptitudes, personality, and native intelligence."[4]

4. Curriculum Guide for Alberta Secondary Schools, 1950. pp. 15-17.

Functions of the Junior High School

The Department of Education in Alberta has stated specific functions for the junior high school which are in addition to the functional objectives of secondary education. It is important, therefore, that instructors of industrial arts interpret the junior high school industrial arts program not only in relation to the functional objectives of secondary education, but more particularly to the achievement of the functions of the junior high school. For this reason they are included below:

"1. To provide a setting in which the adolescent is understood and which makes possible a smooth transition from the elementary to the senior high school.

2. To continue the training of the elementary school in basic skills and knowledge and to broaden this training to include more opportunities for students to think critically and to draw generalizations.

3. To provide for the mental, physical and aesthetic needs of students and to develop talents in these areas.

4. To provide opportunities for the development of acceptable social, moral and spiritual values.

5. To help pupils discover special interests and abilities that will enable them to set realistic educational and vocational goals."[5]

Objectives of the Industrial Arts Program

Within the broad framework established by the functional objectives of secondary education and the more specific functions of the junior high school, the subject area of industrial arts has a most important role. The objectives and desired outcomes listed below for industrial arts establish the purpose of the industrial arts program; indicate the relationship of industrial arts to general education, and indicate the subject matter for industrial arts.

Specific Objectives

1. To develop an understanding of the productive aspects of society.

2. To provide exploratory experiences in the various technologies prevalent in the world of work.

3. To provide an opportunity for students to apply their skills in mathematics, science, and English to the solution of practical problems.

4. To provide an introduction to the multiplicity of occupational opportunities.

5. Junior High School Handbook, 1962. p. 4.

5. To develop an attitude of safety with a respect for safe working habits and practices in the use of tools, equipment and materials.

6. To develop an attitude of personal and social responsibility.

7. To develop a degree of manual skill necessary to satisfactorily complete the requirements of each unit attempted.

8. To provide experiences which permit the growth and expression of individual creativeness.

Definition of Terms

The following are terms that will be used with the revised industrial arts program:

1. Multiple Activity Laboratory - a laboratory or shop where three or more activities are in progress at the same time.

2. Course Area - Area is the general title given to the basic technologies represented. A course area may include one or more units, e. g. electricity-electronics has two units.

3. Course Unit - A unit consists of from nine to twelve weeks of work in an area. There may be several units to complete a course area.

4. Pre-designed Projects - Students at the junior high school level do not have the background of knowledge of tools and materials to design their own projects. The instructor should select or design projects to meet the objectives of the course.

5. Instruction Sheets - These are written teaching aids which contain organized material for the use of individual students. There are four common types:

   (a) Operation Sheet - gives directions on how to perform a single manipulative task. This would include the directions to operate a machine.

   (b) Job Sheet - gives directions on how to do, completely and in proper sequence, a number of operations. The procedure for making a project or doing an experiment would constitute a job sheet.

   (c) Information Sheet - contains everything necessary for the understanding of an instructional unit which is largely informational in nature.

   (d) Assignment Sheet - directs the study to be done by the student on the lesson topic, and may include questions to determine how well the lesson has been learned.

JUNIOR HIGH SCHOOL PROGRAM

(a) The Multiple Activity Program

The multiple activity program is an organizational device by means of which a variety of exploratory experiences can be presented with a minimum of room and equipment. The shop is organized into nine different sections representing the program areas. Each section or bay is large enough to accomodate up to six students. These bays are as self-contained as possible with provisions made for the storage of tools and projects within them. The class is divided into three or more groups with each group working through the course unit in the bay assigned it. After the completion of the unit in from nine to twelve weeks the groups rotate each proceeding to another bay.

As the units consist of from nine to twelve weeks of work, each depending on the number of areas in operation, there will be several weeks unaccounted for. This time, two to four weeks, should be used at the beginning of the year to organize the activities of the groups, draw the first project for one area, teach the beginning lesson of each unit, give demonstrations and provide the information required to get each group started efficiently in their assigned areas.

Once group work begins, the instructor would move from one area to the next giving short lectures and demonstrations each period. The remaining time he would give individual help.

Another method would have the instructor present his lecture and demonstrations to the class as a whole. The lessons would rotate from group to group with material from their respective units. Information sheets would supplement the lesson for later review when the information becomes pertinent to the unit the student is in. The instructor would then review the theory with the individual groups.

Either method or a combination of both can be used. The grading of student achievement should be accomplished by the evaluation of work done on projects or experiments, by administering written tests with a minimum of one per unit and by evaluating the students' general progress in the formation of desirable attitudes such as responsibility and co-operation.

Poor management and lack of planning are bound to result in confusion. Therefore the instructor must have a well devised plan, firmly in mind, before attempting to operate a multiple activity laboratory.

In the one or two shop organization this is the only way we can achieve the objectives we have set of providing broad exploratory experiences to all students. It is necessary that each instructor prepare himself to the best of his ability to meet those objectives.

(b) Course Areas

To provide a wide exploratory experience, nine basic areas are to be considered. The basic areas are subdivided into units. There are fifteen units, each from nine to twelve weeks in length. The minimum number of areas that should be covered in a three year junior high school program should be nine. Where equipment and instructors are available as many as thirteen can be taught. Where industrial arts is taught only two years in the junior high school, a minimum of six areas should be taught.

	Areas of Study	Units
1.	Power Mechanics	one
2.	Metals	
	- sheet and bench metal	one
	- machine shop	one
3.	Electricity-Electronics	
	- electricity	one
	- electronics	one
4.	Computor	one
5.	Wood - 1 and 2	two
6.	Plastics	one
7.	Graphic Arts (type setting, printing, silk screen, book binding)	one
8.	Graphic Communications (photographs, drafting, blue print reading)	one
9.	Industrial Crafts (only two units to be chosen)	
	- ceramics	one
	- art metal	one
	- leather	one
	- lapidary	one
9 areas		15 units

In addition to the nine units listed above, the junior high school industrial arts program includes a testing area and an instructional materials center. The testing area utilizes the materials and some of the projects made in the other areas. The instructional materials center is used as a students' resource room, conference room and research area.

(c) Length of the Program

The recommended minimum is four periods per week based on a forty week school year. The length of a shop period should be not less than a double period at one time.

There is a total of fifteen individual units excluding the testing section which is part of all of them. To benefit most from the program it should start in Grade VII and continue through Grade IX.

The minimum number of units to be taught each year is three with a maximum of five or as determined by the instructor and the time available. By the end of three years in junior high school a student should have covered from nine to thirteen units. If a three year program can not be instituted, the most representative units of productive industry should be chosen and taught in Grades VIII and IX.

(d) Organization and Design of Industrial Arts Areas

The industrial arts area is designed as a multiple-activity laboratory. It is desired that as many areas as possible be contained within one room and that each of the areas be self-contained with regard to tools, machines and materials. An area which is planned to accommodate four to six students is recommended. These small groups would work in the different areas, e.g. four students would work in the sheet metal area, another four in woodwork and yet another four in electricity. Following the completion of required learning experiences in an area, the group proceeds to the next area. This system of rotation insures each student an introduction to all the components of the program.

A multiple-activity laboratory affords each student the opportunity to observe the interdependence of technologies and to visualize the basic tools, machines, and processes in each of the technologies. When more laboratories are available the number of units taught in each can be correspondingly reduced.

(e) Approach

The use of the project in industrial arts has merit. It is to be considered a vehicle for learning and nothing more. When the project becomes the focal point and ceases to be a media for this learning experience it should be discontinued. Carefully selected projects are recommended for some of the units included in this program. The woods, metal, plastics, and leather lend themselves well to the project method. The projects however should be predesigned and permit a measure of successful achievement for all levels of learning. Many of the units such as electricity, electronics, computer technology, and power mechanics,

lend themselves well to an experimental approach. Pre-designed and programmed laboratory exercises will assist in the degree of student understandings. The instructor should have available operation sheets, related information sheets, and job sheets. These would help him and his students or organize their time efficiently.

Test-stand experiments will assist both in the understanding of these areas and in developing an appreciation for the scientific method.

(f) Suggested Organization of Teaching Units

Grade VII	Grade VIII	Grade IX
Graphic Arts	Wood	Electronics
Plastics	Electricity	Power Mechanics
Any Two of Individual Crafts	Graphic Communications	Computer
	Sheet Metal and Bench Metal	Machine Shop

(g) Suggested Transition to the Revised Program

Starting with the units presently equipped for and adding units each year the program can be gradually built up.

An alternative method is to renovate a shop completely in one year. Contact the Supervisor of Industrial Arts for transition suggestions.

In a single industrial arts laboratory it is recommended that nine basic areas be set up. Some of the units can be carried on in the same area by a different class. For example the electricity and electronics would utilize the same area and some of the same equipment.

In a double laboratory set up, the two shops can divide the areas between them. E.g. one laboratory could be used for wood, electricity, electronics, industrial crafts and computer, while the other be set up for metal, power mechanics, plastics, graphic arts and graphic communications.

The planning of the areas or bays should be such that the benches are moveable. This provides for versatility because it makes rearrangement possible. The design of the benches will be such that areas can be made independent of each other.

GENERAL INFORMATION

1. Records

Every instructor should keep the following records:

(a) attendance

(b) daily lesson plan

(c) phase plan for the year

(d) record of student achievement (test marks, project rating, etc.)

(e) inventory of equipment and supplies

2. Size of Classes

Courses and accomodation are prepared on the basis of a class size of twenty pupils.

3. Shop Accomodation and Equipment

The type of shop accomodation will vary from one district to another. There are a number of basic features that are recommended for industrial arts laboratories.

(a) that it be located as a wing of or close to the school.

(b) that the multiple activity type organization be used.

(c) that it have an area of 3,000 square feet in a rectangular shape with the ratio of width to length between 1:1 1/2 or 1:2.

(d) that provision be made for the exhausting of welding, power mechanics and painting areas. A dust collector system should be provided in the woodworking area.

(e) that a concrete floor be used in the metals and power mechanics area with a wood or tile floor in the remaining area.

(f) that there be a master electrical control switch for power outlets, within easy access of the instructor.

(g) that power channels be provided in the floor to allow for flexibility in equipment location.

(h) that an area closed off with glass be provided for the areas of graphic arts and communications.

(i) that adequate storage facilities be provided for materials, tools and projects.

(j) that enough equipment be purchased for a multiple activity shop for six students in each area.

(k) that provision for tool storage be provided in each area.

(l) that unless for specific reasons, open faced tool panels be used. Tools must be available to all students for maximum efficiency.

4. School Opening

Several days to a week should be spent at the school preparing the program prior to opening day. The following points should be attended to:

(a) check the inventory - all tools should be repaired, sharpened, and properly stored.

(b) check materials on hand - there should be material on hand to get the class started the first day.

(c) plan your year's program - prepare a broad outline of the year's work in each grade. Have dates set for the time of rotation, when the groups change their activities.

(d) have the lessons in each area outlined with information and job sheets available to get started.

(e) have the projects selected in each area they are required.

(f) have the record system prepared.

(g) survey project storage space and have lockers assigned by classes. Specific student names given to lockers later.

(h) have a general information sheet prepared for each student outlining general shop procedures and rules, fees required, evaluation criteria, and other information you find pertinent.

(i) if your system has a book-rental scheme, make arrangements to have the initial shop fee collected by the book-rental secretary. You collect the total sum from him later.

(j) have the shop thoroughly cleaned up, painting done when needed, shop coats and aprons clean.

5. Shop Closing

At the end of the school year the instructor must ensure that:

(a) the inventory is checked and reported to the Principal or Secretary-Treasurer.

(b) the students' accounts are audited by a responsible authority, usually the Principal.

(c) the tools are sharpened and needed repairs are ordered.

(d) the tools are either oiled or waxed and put in a secure location.

(e) the shop is thoroughly cleaned and left in creditable condition.

(f) the materials that will be needed in the first quarter of the next term be ordered.

(g) an inventory of job and information sheets is taken and sufficient preparation is made to get started in the fall.

(h) rag bins and paint room supplies are checked. Discard all soiled rags.

(i) batteries are removed from electronic equipment meters, etc.

(j) student lockers are cleaned out.

6. Girls

The industrial arts course is a suitable and desirable exploratory course for girls. If it is possible for the girls to be grouped together they may work through the phases just as do the boys.

7. A separate list of films on industrial arts courses is available from the Audio-Visual Aids Branch Department of Education. These films are listed under subject areas to make selection for a specific topic easy.

The Shop Safety Program

Every shop must have an effective safety program. This does not mean that the promulgation of a set of rules and regulations will satisfy this end. Students must be taught in each and every subject studied within the industrial arts framework, the "hows and whys" inherent in the safety program. It is the responsibility of the instructor to supply continuous and vigilant supervision and to ensure that all students engage in only safe shop practices. A good safety program would include:

1. regular and thorough instruction and revision.

2. constant vigilance.

3. checking and evaluating of student safety habits by the instructor.

4. complete first aid equipment kept in first-class condition.

5. non-skid paint and clearly marked working areas around all machinery.

6. proper clothing with particular attention to eye protection.

7. machines and tools in good working condition.

8. routine reporting of all accidents.

9. good housekeeping.

The following is a sample of safety regulations which the instructor might be expected to enforce:

1. No power machines shall be used by any student before specific instruction has been given with regard to safe operation and safety precautions.

2. No power machine shall be used while the instructor is absent from the shop.

3. No machine shall be used by any student unless adequately guarded.

4. Approved eye protection must be worn for certain operations.

Note: A good safety slogan which should be put into practice at all times - a place for everything and everything in its place.

There are five basic steps in safety education:

1. Set a good safety example for students.

2. Instruct each student thoroughly in the safety precautions of his job.

3. Keep all tools sharp and in good condition.

4. Keep all safety devices in proper use.

5. Follow up safety instructions constantly. The shop will be as safe as the instructor makes it.

Dress and deportment play an important part in the operation of a safe shop program. Students and instructor should be neatly dressed at all times and the instructor should take care to ensure that no loose and dangerous clothing is worn. Safety aprons, goggles, gloves, should be used wherever necessary.

It should be pointed out that failure to comply with every reasonable safety precaution, may jeopardize the instructor's position in any claim for compensation. Each school should receive the excellent publications and bulletins dealing with accident prevention and safety procedures distributed by the Workmen's Compensation Board.

Note: Accidents must be promptly reported to some senior school authority. If no other person is designated, this authority is the Principal.

HOW TO USE THIS GUIDE

Each unit is outlined in uniform manner. The "do" operations appear in the left hand column. A student should have performed the majority of these activities in the time allotted to the unit. As there is enough content to require 12 weeks of work, some of it will have to be deleted when taught for a shorter period.

The "know" column is on the right hand side. The student should know the information related to the "do" operations as well as general knowledge about the area. This would include occcupational and industrial information, safety precautions and the interdependence of the technologies.

The operations are numbered to relate to the information column. The topics are listed in a logical teaching sequence.

Reference books are listed following the course. These are listed in order of suitability and usefulness.

A special list of audio-visual aids is available where films are listed under course headings. Some material is useful under several topics and will appear there.

A Method of Procedure

1. Study the unit you are developing. Read the material in the reference books and manuals. Then develop about ten lessons in logical order that will cover the content in the "know" column.

2. Develop a series of demonstrations that will reinforce and become part of your lessons.

3. Select audio-visual materials, films, filmstrips, charts, etc. that can be used with your lesson material.

4. Develop an information sheet on each formal lesson. This is given to the student and contains the "gist" of the lesson. An exercise sheet can be prepared to follow the information sheet which the student does for homework. The exercise sheet consists of a series of questions to force the student to recall the information given in the lesson. The exercise questions should be based on the information sheet. Short-answer type questions can be used. These exercises should be checked by the teacher or used as a quick review.

5. Develop projects, experiments, or exercises based on the "do" operations. Write out procedure sheets from which the student works.

6. Next prepare the materials needed by the students to carry out their work. Have all materials needed on hand. With a predesigned project this can be done. Material can be pre-cut to rough size and the package handed to the student. This will eliminate a waste of both time and material.

7. Prepare a system of check points. Prepare quizzes, tests, and progress charts to evaluate mastery of content and work accomplished.

8. Plan a personnel system that places responsibility for tools, clean-up, etc. on the students.

9. Prepare your plan for the year. Define the units to be taught in each grade. Set dates for rotation.

10. List the lesson topics planned for each unit.

11. Prepare a daily record book and list all lesson topics to be covered a week ahead of time.

12. You are prepared. You can now enjoy the excitement of "teaching".

ELECTRICITY

Introduction

Automation, which is producing more leisure time as well as a higher standard of living for us, and space exploration, which satisfies man's thirst for probing the unknown would not be possible were it not for the extensive use of electrical energy in our present day society. This use is not confined to urban centres alone. It is playing an increasing role in all rural areas as well. In all industries or occupations, some knowledge of electricity will be beneficial. Therefore, it is felt that we can no longer neglect providing students in the junior high school with exploratory experiences in electricity which will help them interpret a productive society, reinforce and synthesize the academic disciplines and serve as a measure of guidance to the students in planning for their future.

As much activity and experimentation as possible should be provided in each unit but these must not be just "busy work". Construction of projects which require a great deal of time but illustrate possibly only one electrical principle should be avoided. Rather, the activities should be such that an optimal amount of electrical principles are involved.

Specific Objectives

1. To develop interest in electrical systems and thus enable students to recognize the importance of these in modern living.

2. To develop an understanding of basic electrical principles and thus remove the air of mystery regarding electricity.

3. To acquaint students with electrical testing equipment.

4. To acquaint students with electrical symbols and diagrams.

5. To help students recognize the vastness of the field of electricity, and the possibilities for further training in these fields in vocational and technical schools.

6. To develop safety habits in working with electricity.

Suggested Procedure

In a multiple-activity program the student must be able to do a considerable amount of work by following written or printed instructions.

It is essential that related information, experiments, and instruction sheets which are given to the student be clearly written. It is also essential that suitable check points be written into the program so that students' progress can be quickly evaluated before he proceeds from one job to another. Experiments should have well directed questions written into them so that the student is sure to make the proper observations and draw proper conclusions.

Course Content

What the student should be able to:

Do	Know
1. View appropriate films or film strips covering this aspect or do research using reference books.	1. Uses of Electricity a. in the home b. in communications c. in transportation d. in construction e. in manufacturing f. in medicine.
2. Experiments in which electricity is produced by each of the sources outlined.	2. Sources of Electricity a. generators b. chemical cells c. solar cells and photo-tubes d. heat e. pressure and vibration f. friction g. bio-electricity - developed in the bodies of humans and animals.
3. Research Experiments to check insulators and conductors.	3. The use of conductors and insulators.

Do	Know
4. Connect various types of circuits.	4. (a) What is Electricity? - The electron theory. (b) Circuitry i. simple circuit ii. series circuit iii. parallel circuit iv. voltage drops v. using a variable resistor vi. various types of EMF vii. circuit breaker and fuses.
5. Make current, voltage, and resistance measurements.	5. Measurements of Voltage, Current, and Resistance.
6. Problems involving current, resistance and voltage.	6. Simple application of Ohm's Law.
7. Perform experiments with magnets. Test materials for magnetic properties.	7. Magnetism a. magnetic field b. laws of attraction and rep. c. use of magnets..
8. Experiment to show generator action.	8. Electro-magnetic Induction - Generator.
	9. The workings of the simple Electric Motor and Generator.
10. Experiment with pre-wound used to demonstrate transformer principle.	10. The transformer principle.
11. Measure output of transformer.	
	12. The meaning of Energy and Power.
	13. Safety in Electricity.

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ELECTRONICS

Introduction

Electronics is that part of the total field of electricity which deals with the vacuum tube, the transistor, and the circuitry associated with these. Because of automation, the increased use of computers, space exploration, and improved communication systems, electronics has become more and more important in our present day society. In an exploratory course such as this, it would be impossible to cover all phases of electronics in detail or to study the circuitry and components involved in detail. To study only some of these, however, would defeat the purpose of the course which should be in keeping with the general objectives of the Industrial Arts Program. Therefore, an attempt is being made to give the students as much breadth of exploration as possible. A broad selection of systems should be used and their applications in our society emphasized. To do this the student should be given the overall story of the operation of each system first, and then he should study the various sections that comprise the system. Study of components and detailed circuitry should be done only as time permits and student ability indicates.

Specific Objectives

1. To acquaint the student with as many types of electronic systems or equipment as possible.

2. To teach the student the operating principles of these systems and the functions of the sections making them up.

3. To relate to the student the uses of these systems in our society.

4. To teach the student how tubes amplify, how A. C. current is rectified, what radio waves are, how transmitters work, how speakers and microphones work, how photo-tubes work, how time-delay circuits work, etc.

5. To give the student an opportunity to discover his ability to understand electronics and therefore make this field more meaningful to him upon entering a high school or technical school.

Suggested Procedure

The method of teaching the electronic systems will depend to some extent upon the equipment used. In some cases systems such as radio receivers,

amplifiers, etc. can be bought in units which can be put together in various combinations. The approach in such cases would be the assembly of the units into a system. After the assembly, the various units would be taught by the instructor or read about by the student. Various experiments could also be run on this equipment. For example, the power supply filter could be removed to show what its purpose is in the system. In other cases the systems would be complete so that no assembly would be possible and a different approach to the experimentation would have to be taken. The related information given to the students, should point out commercial and/or other applications of all the systems studied. An evaluation by means of a test or tests should be made so that a profile of the students' interests and abilities in the various units of the industrial arts program can be made at the end of the term. Demonstrations and instruction by the teacher will supplement the written exercises and related information sheets.

Course Content

What the student should be able to:

Do	Know
1. List the applications of electronics in our society.	1. The use of electronics in our society. a. in the home b. in industry and business c. on the farm d. for communication e. for automation f. in medicine
2. Read about and list occupations and branches of electronics.	2. The opportunities in electronics.
3. Use a neon bulb and make a rough check on the voltage and frequency in AC and DC circuits.	3. The behaviour of AC and DC circuits.

Do	Know
4. Use a neon bulb and check the effect of a capacitor in an AC and DC circuit.	4. The effect of capacitance in circuits - AC and DC.
5. Use a neon voltage test to check the effect of resistance on voltage.	5. The effect of resitance in circuits.
6. Draw a simple diagram of a carbon microphone circuit. Prepare a short talk on how a crystal microphone works. Use an oscilloscope to illustrate this.	6. How microphones work, crystal and carbon.
7. Closely observe the actions of a speaker on a radio receiver or amplifier. Be prepared to explain how the speaker works, or write a short paragraph on its action.	7. How a PM speaker works.
8. Hook up a suitable circuit to illustrate this.	8. The effects of a diode in a circuit, on current flow.
9. Use an available power supply and oscilloscope, check the AC wave form, the pulsating DC wave form, and the filtered wave DC voltage.	9. How a power supply works - type used in receivers, amplifiers, etc.
10. Illustrate this by using an oscilloscope.	10. How amplification takes place.
11. Demonstrate uses of oscilloscope.	11. General uses of an oscilloscope.
12. Broadcast music from a record player with a phono-oscillator and receive it on a receiver.	12. How radio waves are sent into space.
13. Make a block diagram of the turntable, voltage amplifier, power amplifier, speaker, and the power supply.	13. How a record player works.
14. Make a block diagram of the sections, making it up. Use an oscilloscope in the various sections to show the amplification of the signal.	14. How an amplifier works.

Do	Know
15. Make a block diagram of radio receiver.	15. How a receiver works.
16. Hook up a photo cell relay and observe its operation.	16. How a photo cell works.
17. Hook up a time delay relay and be prepared to explain its operation.	17. How a time delay relay works.
18. Hook up a circuit using a phototube, a neon lamp, and a capacitor to measure the intensity of light. Also use an available light meter to measure the intensity of light.	18. How light intensity is measured.
19. Make a simple printed circuit for a crystal tuner.	19. What printed circuits are.

Bibliography

*1. Evans-Porter, Experimental Basic Electronics, McKnight and McKnight Publishing Co., Bloomington, Illinois.

*2. Gerrish, Howard M., Electricity - Electronics, Goodheart-Willcos Co., Inc., Chicago, 1964.

*3. Buban, Schmitt and Kirchner, Electricity and Electronics, McGraw-Hill Publications. 1964.

4. University of the State of New York, the State Education Department, Albany, Electronics, Project Ideas.

5. Grob, Bernard, Basic Electronics, New York City, McGraw-Hill Book Co., Inc.

6. Schrader, Robert L., Electronic Communications, New York City, McGraw-Hill Book Co., Inc.

7. Van Valkenburgh, Nooger and Neville, Inc., Basic Electronics, New York City, John F. Rider Publisher, Inc.

* Prime references.

Introduction

Woodwork is one of the most satisfactory mediums in which to express oneself. Although many other materials are used as a substitute, wood is a living material with warmth, texture and beauty, and no other material embodies all the fine qualities of wood.

With the advancement of the technologies and the growth of our country, the skills of the woodworker have found an ever-widening field in all branches of construction. Canada's largest industry is building and the woodworker is the backbone of this industry.

(1) Woodwork in a multiple-type program.

Several projects should be assigned to this area of instruction designed to give the student, in the time available, the optimum of experiences with tools, machines and materials. Quality rather than quantity is stressed. The student is expected to work steadily following complete written instructions prepared by the instructor for the projects. The instructor will demonstrate machines and operations to the group as the need arises.

(2) Safety.

The shop organized for a multiple program must have an effective safety program. Adequate guards on machines; students properly clothed for their work; thorough instruction on the use of all hand tools and power machines. No machine should be student operated until complete instructions have been covered by the teacher.

General Objectives

1. To acquaint the student with common hand tools and basic power tools in the woodwork industry.

2. To enable the student to understand some of the working properties of common domestic and foreign woods.

Specific Objectives

1. To provide an opportunity for students to discover special aptitudes in woodworking.

2. To further the student's understanding of drawings and his ability to interpret them.

3. To develop to some degree the student's manipulative dexterity in the safe handling of tools, machines and materials.

4. To instill in the student an appreciation of high standards and pride in workmanship.

Course Content

What the student should be able to:

Do	Know
1. Measure distances.	1. System of measurement.
2. Take an inside measurement.	2. Kinds of measuring tools.
3. Take an outside measurement.	
4. Form a straight line between two points.	4. Layout tools; types, sizes.
5. Set a marking gauge.	
6. Gauge a line with a marking gauge.	
7. Use a finger gauge.	
8. Gauge with pencil and ruler.	
9. Use a try square.	
10. Use a combination square.	
11. Lay out rounded corners.	
12. Divide a board into a number of equal parts with a ruler.	

Do	Know
13. Test for straighness of a surface.	13. How to select and care for testing tools.
14. Test for squareness.	
15. Cut with a crosscut saw.	15. How to select and care for sawing tools (crosscut, rip, keyhole, coping,back).
16. Cut with a ripsaw.	
17. Cut with a backsaw.	
18. Disassemble a jack plane.	18. How to select and care for bench planes.
19. Assemble the double plane iron.	
20. Adjust the plane for depth of cut.	
21. Adjust the plane iron laterally.	
22. Plane faces.	
23. Plane an edge.	
24. Plane an end.	
25. Square a board.	
26. Plane a chamfer.	
27. Plane a bevel.	
28. Whet a plane iron.	
29. Adjust a rabbet plane.	29. Kinds of special planes.
30. Make a paring cut with a wood chisel.	30. How to select and care for edge cutting tools.
31. Whet a chisel.	
32. Mark with a marking knife.	
33. Insert a bit in a brace.	33. How to select and care for boring tools.
34. Bore vertical and horizontal holes.	
35. Bore a hole to a depth.	

Do	Know
36. Drill holes with a hand drill.	
37. Face nail.	37. How to select and apply fasteners (such as nails, screws, etc.)
38. Set a nail.	
39. Clinch a nail.	
40. Nail into end grain.	
41. Withdraw a nail with a hammer.	
42. Drive a screw.	
43. Withdraw a screw.	
44. Apply glue.	44. Common types of glues and adhesives.
45. Clamp board.	
46. Insert a file in a wood handle.	46. Select smoothing tools.
47. Care for wood files.	
48. Cut and fold abrasive papers.	48. Types of coated abrasives and how to select them.
49. Sand-paper flat surfaces.	
50. Prepare a surface for finishing.	50. Common wood finishes.
51. Apply an oil finish.	
52. Brush a finish.	
53. Polish a finished surface.	
54. Install sabre saw blades.	54. Care and characteristics of sabre saws.
55. Operate the sabre saw.	
56. Cut plywoods.	
57. Select and check twist drills.	57. How to select and care for electric hand drills.
58. Correctly drill with electric drill.	
59. Rip with the bandsaw.	59. Safe care and upkeep of bandsaw.

Do	Know
60. Cross cut with the bandsaw.	
61. Cut angles on the bandsaw.	
62. Adjust fence and guard on bandsaw.	
63. Mount stock for face plate turning.	63. Safe care, operation, and upkeep of wood lathe.
64. Cut with wood turning chisels.	
65. Sand on the lathe.	
66. Mark out patterns for turning.	
67. Apply finishes on the lathe.	
68. Polish lathe projects.	
69. Study tree growth charts. Test hard and soft woods.	69. Trees and lumber. Kinds of trees. Properties of various kinds of woods. Qualities and uses.
70. View film.	70. Story of lumbering.
71. List occupational areas related to woodworking.	71. Opportunities in wood working.
72. Select one occupation in woodworking and list its job specifications, e.g. education required, skill training needed, etc.	

NOTE: Any desired selection of operations to complete the selected project and compliment the established objectives may be chosen for Unit 1, Woodwork. The remaining operations, not used in Unit 1, should be included in the work contained under Unit 2, Woodwork.

References

*1. John L. Feirer, Industrial Arts Woodworking, Copp Clark Publishing Co., Ltd., 1965.

*2. Groneman and Feirer, General Shop, McGraw Hill Publications.

3. L. P. McDonnell, Hand Woodworking Tools, Delmar Publishers, Inc.

4. Hammond, Donnelly, Harrod, Rayner, Woodworking Technology, McKnight and McKnight.

5. Wolansky, Woodworking Fundamentals, McGraw Hill Publications.

6. D. W. Olson, Industrial Arts for the General Shop.

7. R. G. Waring, Modern Wood Finishing, The Bruce Publishing Company.

8. Getting the Most Out of Your Lathe, Deltacraft Publication.

9. Getting the Most Out of Your Bandsaw, Deltacraft Publication.

* Prime references.

GRAPHIC COMMUNICATIONS

Introduction

Graphic communications refers to that type of communication which is written, printed, photographed, silk screened, engraved, inscribed, drawn or painted in order to appeal to the eye for communication purposes. This area, in its broad meaning, would include more than is possible to cover in the junior high school program. To be more specific, graphic communications includes:

- Writing
- Printing, including typing
- Drafting
- Blueprint Reading
- Silk Screening
- Photostats
- Microfilming
- Photography
- Blueprinting
- Blue-Line Printing
- Black and White and Color-Line Prints
- The Ozalid Process
- Line Etching
- Mimeographing
- Hectographing
- Lithography
- Other Processes - new ones are appearing.

It is obvious that all of these cannot be covered, therefore one is faced with the task of selecting those which will provide the student with the most worthwhile experiences in keeping with the general objectives of industrial arts.

When one considers how much our modern society depends on graphic communications, it cannot be denied that a large portion of our industries employing thousands of people are concerned with this type of communication.

Specific Objectives

1. To impress upon the student the possibilities of a vocation in the field of graphic communications.

2. To introduce the student to mechanical drawing and point out to him the importance of drafting as the "universal language" of industry.

3. To teach the student elementary blueprint reading.

4. To expose the students to as many processes of reproducing drawings and printed material as possible.

5. To introduce the student to photography. This should also include developing, enlarging and contact printing.

6. To introduce the student to any other phase of graphic communications for which the instructor has facilities and in which he is particularly skilful.

Selection and Analysis of Course Content

A typical selection of content to be explored in this area might be as follows:

- Drafting
- Blueprint Reading
- The Ozalid Process
- Hectographing and/or mimeographing
- Photography.

Drafting

Drawing was the first graphic communication developed by man. The first symbols to represent sound were developed from simplified drawings. Simple drawing or sketching is used extensively even today to convey ideas, especially when they are of a technical nature.

Drafting is a mechanical drawing done with the aid of tools or instruments. It is used to put into pictorial form instructions for putting together manufactured articles and construction projects. It is done the same way throughout the world, thus being a "universal language". The student should be introduced to this language and the tools used in it.

Course Content

What the student should be able to:

Do	Know
Drafting	
	1. The names and uses of the: a. drawing board b. T square c. 45 set square d. 30-60 set square.
2. Set up material for drafting.	2. Methods of fastening paper to a drawing board.
	3. Method of laying out a drawing.
4. Simple orthographic drawing.	
5. Simple isometric drawing.	

Do	Know
6. Dimension drawings.	6. Various methods of dimensioning a drawing operation.
7. Procedure of putting in a title and other pertinent information (Neat printing using the single stroke, upper case letters in Gothic.)	
	8. The names and uses of such conventional lines as: a. border lines b. construction lines c. outline lines d. dimension lines e. extension lines f. hidden lines.
9. Tracings of drawings.	9. Techniques of tracing.
10. Blueprinting and ozalid printing and a mimeograph or hectograph print.	10. Reproduction of drawings.

Blueprint Reading

1. Obtain the necessary information from a blueprint.	1. How to interpret a variety of mechanical drawings as to measurements, material, finishes, drilling and threading, etc.
2. Do exercises which have isometric and orthographic drawings in them.	2. The relationship between an isometric and an orthographic drawing.
	3. Abbreviations used on drawings.
4. Use tables from exercise book to interpret blueprints.	4. How to interpret tables in exercise book pertinent to the reading of blueprints.

Photography

1. Take pictures with a box camera.	1. The camera and its essential features and components such as the lens, the lens opening, the shutter, etc. Methods of taking effective, artistic pictures.

Do	Know
2. Use of refinements and accessories.	2. Use of accessories or refinements such as a light meter, range finder, flash attachment should be explained.
	3. Films - glass plates and flexible film.
	4. Film characteristics: a. speed b. graininess c. color sensitivity.
	5. Paper characteristics.
	6. The Dark Room: a. general equipment b. materials and equipment for negative and paper development. c. material and equipment for printing and enlarging.
7. Develop films.	7. Film development.
8. Develop paper prints and enlargements.	8. Paper development.
9. Print from negatives.	9. Contact printing.
10. Enlarge pictures.	10. Enlarging.

References

1. Blueprint Reading:

   * a. Thomas Diamond, Primer of Blueprint Reading, Bruce Publishing Company, Chicago 6, Illinois.

   b. Lightle, Blueprint Reading and Sketching, McKnight and McKnight Publishing Company, Bloomington, Illinois.

   c. Steinke, Blueprint Reading, Checking and Testing - Part 1 and 2, McKnight and McKnight Publishing Company, Bloomington, Illinois.

   d. Wyatt, Edwin M., Blueprint Reading, Bruce Publishing Company, Bloomington, Illinois.

2. Drafting:

* a. Harman, Introduction to Mechanical Drawing.

b. Ermeling, W. W., Mechanical Drawing, First Year.

c. Cobaugh, H. B., Shop Drawing for Beginners.

d. Shaeffer, Glenn N., Basic Mechanical Drawing.

All of the above are available from:

Bruce Publishing Company,
Chicago 6, Illinois.

e. Introduction to Applied Drawing, General Publishing, 200 Adelaide Street West, Toronto, Ontario.

3. Photography:

* a. McCoy, Robert A., Practical Photography, McKnight and McKnight Publishing Company, Bloomington, Illinois.

b. Samuel Epstein and David W. DeAmend, How to Develop, Print and Enlarge Pictures, Grossett and Dunlap Inc., Publishers, New York.

* Prime references.

GRAPHIC ARTS

Introduction

For thousands of years man has been putting down his thoughts in pictures and adding words; today newspapers, magazines and books provide this kind of communication. In fact, pulp and paper is one of the largest products manufactured in Canada at present. Since printing and publishing materials is a leading industry in Canada the graphic arts section of Industrial Arts assumes considerable importance to students. In this course they should become acquainted with the operations connected with printing and publishing.

Scope

The objective of including Graphic Arts is to provide the students with an exposure to the use of some printing equipment and materials and to relate these to the printing industry.

A. History

(a) the origin and development of letters.

(b) The development of the alphabet.

(c) materials and processes used in making early records.

(d) Medieval recording.

(e) invention of movable type.

(f) invention of slug casting composing machines.

(g) processes and machines - their development and effects on civilization.

(h) development of paper and inks.

B. Importance of the Graphic Arts Industry

to home, industry, communications and transportation.

(a) economic

(b) employment

(c) products

(d) our dependency on it.

C. Processes and Equipment

(a) the old vs the new

(b) raw materials into usable materials

(c) hand tools - operations and skills

(d) machine tools - operations and skills.

D. Guidance

(a) Employment possibilities: with regard to types of jobs, working conditions, wages and hours, apprenticeship physical and mental requirements, health and safety.

(b) Consumer value: appreciation of commercial printing; labor unions, skilled, semi-skilled and unskilled labor.

At least 9 - 12 predesigned projects complete with detailed job sheets are necessary for a 10 - 12 week period in Graphic Arts. The students progress at their own individual speeds. Some may complete all the projects while others may only do 5 or 6 of them. The students should experience the following processes in the Industrial Arts General Shop.

Course Content

What the students should:

Do	Know
1. Compare type of different sizes and faces.	1. The layout of California Job Case.
	2. Common terms used in printing.
	3. Printing materials used.
4. Set and hold stick properly.	4. How to use composing stick.
5. Assemble the type in a job stick.	

Do	Know
6. Read line of type and correct errors.	6. Correct way to read a line of type.
7. Center a line of type.	
8. Justify a line.	8. How to justify. - flush left - center - flush right.
9. Remove type from job stick.	
10. Tie form in galley.	10. How to use a galley and tie a form.
11. Make proof.	11. How to make and correct a proof.
12. Lock up chase.	
13. Ink the press.	13. Select ink - kinds.
14. Select paper.	14. Kinds of paper.
15. Set gauge pins.	
16. Set keepers on letter press.	
17. Run the letter press.	
	18. Four basic printing methods. - rebel - intaglio - lithography - screen.
19. Clean the type, rollers and ink plate.	
20. Re-distribute type.	
21. Write a brief description of each including its advantages of disadvantages.	21. The different kinds of presses. - platen - cylinder - type-revolving cylinder - web fed rotary - offset.
22. Make a matrix for a rubber stamp.	22. Process of rubber stamp making.
23. Make a rubber stamp.	23. Materials used and their function.

Do	Know
24. Set up letters on show card printer.	24. Use of show card printer.
25. Ink the plate and use the brayer.	
26. Operate printer.	
27. Clean type, brayer and plate.	
28. See film or tour plant.	28. Manufacturing process of pulp and paper.
29. Interview a printer or publisher.	29. Opportunities in the printing industries.

Evaluation and Testing

Tests should be administered at regular intervals (at the end of the sixth and twelfth week) to emphasize the printing and publishing industry. The students should have a general knowledge of the materials, processes, and jobs involved without getting into too much detail on particular tools and machines in the shop.

References

* 1. Kagy, Graphic Arts, General Publishing, 1961.

* 2. Cleeton, Pitkin & Cornwell, General Printing, McKnight and McKnight Publishing Co. 1963.

3. Ralph W. Polk, The Practice of Printing, Chas A. Bennett Co. Inc., 1964.

4. H. E. Jackson, Printing: A Practical Introduction to the Graphic Arts, McGraw Hill Book Company, Inc., 1957.

5. C. W. Hague, Printing and Allied Graphic Arts, Bruce Publishing Co. 1957.

6. Darvey E. Carlsen, Graphic Arts, Chas A. Bennett Co. Inc., 1958.

7. Eisenberg and Kafka, Silk Screen Printing, General Publishing Co. 1957.

Suggested related information for the printing area -

8. Comprehensive General Shop Course: Bureau of Industrial Arts Education, New York State Education Department, Albany, New York.

9. About Pulp and Paper, available from Canadian Pulp and Paper Association, Sun Life Building, Montreal, Canada. (free).

* Prime References.

POWER MECHANICS

Introduction

This course is an attempt to develop in the student a knowledge of and appreciation for the sources and application of energy. The use of engines as a power supply has relieved man of much of the drudgery of work.

It is important that all students learn to understand the fundamentals involved in changing energy from one form to another and then harnessing it to some useful purpose through mechanical means.

Specific Objectives

1. To acquaint the student with various forms of energy and the units which convert this energy into usable power.

2. To gain knowledge of the utilization, transmission, and control of this power.

3. To familiarize the student with the operations of basic internal combustion engines.

4. To learn the safe use and care of the common tools used in this area.

Scope

This power mechanics course will include the study of the various forms of energy, its transmission and control with the laboratory emphasis on common one-cylinder gasoline engines.

Course Content

What the student should be able to:

Do	Know
1. Simple experiments to illustrate the principle of the steam engine, turbine, water wheel, etc.	1. Sources of power - muscular - wind and water - hydro-carbons - nuclear - solar - chemical.
2. Read introductions to power in the suggested primary references.	

Do	Know
	3. Engine classification (a) External combustion - reciprocating - turbine - nuclear (b) Internal combustion - gasoline - diesel - jet - rocket.
4. Disassemble and reassemble cut-away models of one cylinder two stroke and four stroke cycle engines.	4. Design, names of major parts and arrangements of similarities and advantages of two stroke and four stroke cycle engines.
	5. Extent of uses and applications - Common fasteners and applications - Common hand tools, their uses, care and safety.
6. Trace fuel flow through engine.	
7. Remove, clean and replace fuel system components.	7. Safety precautions in handling fuel. Fuel refining processes.
8. Trace fuel flow through carburetor.	
9. Disassemble carburetor, identify parts and reassemble.	9. Names and functions of fuel system components.
10. Remove and service air-cleaner.	
11. Adjust idle and high speed fuel mixtures.	
12. Adjust choke.	
	13. Safety regarding operation of moving parts, heat and carbon monoxide.
	14. Principles of science applied in carburetion.
	15. Types of carburetors.
	16. Significance of air-fuel ratios.
	17. Types of air-cleaners.

Do	Know
	18. Functions of air-cleaners.
19. Trace oil flow through pressure lubrication system.	19. Kinds of lubricants.
20. Trace oil path through splash lubrication system.	20. Purposes of lubrication.
21. Trace oil path through oil-mist lubrication system.	
22. Mix fuel and oil for oil-mist lubrication system.	
23. Compare carbon formation in two-stroke and four-stroke cycle engines.	23. Causes of oil contamination.
	24. Function of oil filters.
25. Identify and inspect different types of oil pumps.	25. Types and operation of oil pumps. Operation of oil pressure relief valves.
	26. Principles of science applied by pressure lubricating systems and gauges.
27. Compare various types of bearings and bearing surfaces.	27. Types and purposes of bearings.
28. Remove, clean, adjust and test spark plug.	28. Types of spark plugs.
	29. Functions of spark plugs in ignition timing.
30. Remove, test and replace capacitor.	30. Function of capacitor in magneto ignition systems.
31. Test ignition coil windings for short or open circuit.	31. What short or open circuits are.
32. Remove and replace breaker point assembly.	32. Function of breaker points in ignition timing.
33. Adjust gap and ignition timing.	33. Function of breaker point cam in ignition timing.
34. Compare flywheel magneto ignition system with battery system.	

Do	Know
35. Trace manual speed control linkage.	35. Operation of simple machines - lever, pulley, wheel and axle, inclined plane, screw and wedge.
36. Adjust throttle linkage for low and high speed control.	36. Function of throttle in speed control.
37. Trace air-vane governor air path.	37. Name and function of air-vane governor parts.
38. Trace air-vane governor speed control linkage.	38. Principles of science applied by air-vane governor.
39. Remove, examine and replace centrifugal governor.	39. Name and function of centrifugal governor parts.
40. Trace centrifugal governor speed control linkage.	
	41. Principles of science applied by centrifugal governor.
42. Trace source of movement and path of air through air-cooled engine.	42. Principles of science applied by air-cooled systems.
43. If liquid-cooled engine is available, trace path of liquid through the system.	43. Principles of science applied by liquid-cooled systems.
	44. Reasons for rust and scale.
	45. Functions and operation of water pumps.
46. Remove, examine and replace thermostat.	46. Functions and operation of thermostats.
47. Prepare and check anti-freeze solutions.	47. Kinds of anti-freeze solutions.
	48. Freezing points of various liquids.
49. Mock-ups to indicate methods of power transmissions if time permits and as suitable equipment is accumulated.	49. Methods of power transmission (Mechanical advantage, direction change and control) - gears - belts and pulleys, chains and sprock, etc. - fluid couplings and hydraulics - cams and eccentrics - pitmans - splines and shafts - clutches - positive acting, slipping.

Do	Know
50. Any additional experiments in power transmission and control, when suitable hydraulic and pneumatic demonstration units become available.	50. Principles of hydraulics and pneumatics, pumps and pistons, orifices, valves, and gauges.
51. When a suitable small engine test stand becomes available the following comparative tests should be performed on small two and four stroke cycle gasoline and diesel engines: - Fuel consumption tests - Torque test - RPM tests - Thermal efficiency tests. (It is conceivable that with the limited time available for the power mechanics unit, the testing activities outlined above may well replace much of the dis-assembly and reassembly of live motors and provide for better attainment of the objectives of this course.)	
	52. Carburetor setting for best air-fuel ratio for best power and performance. Plug selection for the engine. Variations in engine output under varying temperature, humidity and pressure. R.P.M. at which engines produce maximum horsepower.
53. Read guidance information available.	53. Have some knowledge of related fields.
54. Visit suitable local industries.	54. Opportunities for further study of the subject.
55. Discuss the subject with the teacher, guidance personnel and persons in the field.	55. Job opportunities.

References

* 1. P. H. Atterberry, Power Mechanics, Goodheart-Willcox Co. Inc.

* 2. J. W. Duffy, Power, Prime Mover of Technology, McKnight and McKnight.

* 3. M. Shalka, Power Workbook, Hillcrest Junior High School, Edmonton.

4. H. T. Glenn, Exploring Power Mechanics, Copp Clark Co.

5. Groneman and Feirer, General Shop, McGraw-Hill of Canada Ltd.

6. Gerbracht and Robinson, Understanding America's Industries, McKnight and McKnight.

7. Stockel, Auto Mechanics Fundamentals, Goodheart-Willcox Co., Inc.

8. Stephenson, Power Mechanics, Delmar Publishers Inc.

9. Nash, Automotive Fundamentals, McGraw-Hill of Canada Ltd.

10. Purvis, All About Small Gas Engines, Goodheart-Willcox Co., Inc.

11. ABC's of Hand Tools, Booklet by G.M.C.

12. Power Primer, Booklet by G.M.C.

13. Power Goes to Work, Booklet by G.M.C.

14. Story of Power, Booklet by G.M.C.

15. Diesel - The Modern Power, Booklet by G.M.C.

16. How the Wheels Revolve, Booklet by G.M.C.

17. Transportation Progress, Booklet by G.M.C.

18. General Theories of Operation, Briggs and Stratton, Milwaukee.

19. Evinrude Service Manual, Outboard Marine, Peterborough, Ontario.

20. Paul E. Blackwood, Push and Pull (Story of Energy), McGraw-Hill of Canada Limited.

21. A. Morgan, The Boy's Book of Engines, Motors, and Turbines, C. Scribner and Sons.

22. A. Marcus, Power Unlimited, Prentice-Hall of Canada.

* Prime References.

PLASTICS

Introduction

This course in plastics will introduce one of the most fascinating areas of science and industry known today.

Every day we see some new and beautiful product made from plastics. Things we never dreamed could be made of plastics a few years ago, are now commonplace - boats, pools, air mattresses, raincoats, galoshes, clothing, and thousands of other products.

Why this sudden popularity of plastics? Scientific developments are the answer. New plastics have been createdwhich are more useful, more beautiful, and cheaper than the materials they have replaced. We all have occasion to use plastics every day. For most of us, it seems safe to say that there is no other type of material which we use so often and about which we know so little.

Specific Objectives

1. To provide the student with some basic experiences with plastics.

2. To acquaint the student with various forms of plastics and some of their characteristics and limitations.

3. To impart an appreciation for plastics as used in the home and community.

4. To develop an appreciation of good design and workmanship in plastic materials.

5. To acquaint the student with some of the methods and processes used in the plastic industry.

Course Content

What the student should be able to:

Do	Know
1. Plan in plastic.	1. (a) Some characteristics of plastics such as thermosetting, thermoplastic, plastic memory, ability to transmit light,etc.
	(b) Common types of plastics such as acrylics, acetates, cellophane, dacron, mylar, nylon, orlon, phenolics, polyethylene, vinyls, etc.
2. Lay out stock.	2. Lay out tools and how to use them for plastics.
3. Cut out stock.	
4. Square up stock.	
5. Form plastic by heat.	5. Various methods of shaping plastics - heat forming, casting, cutting, etc.
6. Join plastic by heat.	6. Methods of joining plastics - welding, cementing, screws, rivets, etc.
7. Join plastic pieces together.	7. Various cements and their uses.
8. Laminate plastic.	
9. Cement plastic.	
10. Sand plastic.	
11. File plastic.	
12. Buff and polish plastic.	
13. Color plastic.	13. How to color plastics.
14. Operate machines which form and shape plastics.	14. Various methods of machining plastics, and the requirements of each.
15. Identify common plastics.	

Do	Know
16. Administer some tests to common plastics.	16. Various tests for common plastics - heating, odor, burning, solubility, specific gravity, scratch, bending, and flexibility tests.
17. Cast in plastic.	17. Methods of casting simple forms in plastics.
18. Decorate the surface of plastic.	18. Methods of using various burrs for surface decoration.
19. Internal carving in simple shapes.	19. Carving procedures.
20. Mold by foaming styrene beads.	20. The foaming properties of styrene.
21. Rotational molding.	21. What "plastisols" are. How to use plastisols for hollow molding as in toys.
22. Slush molding.	22. How to form "open" projects in plastisol as boats.
23. Blow forming.	23. The difference between blow forming and vacuum forming.
24. Vacuum forming.	
25. Injection molding.	25. The difference between injection and extrusion molding.
26. Extrusion molding.	
27. Compression molding.	27. How compression molding is done and used.
28. Transfer molding.	28. The advantages of transfer molding over compression molding.
29. Fiberglas repairing.	29. How to apply fiberglas.
	30. How to color fiberglas.
	31. Opportunities in the plastics industry.

Suggested Projects

1.	Zipper pulls	6.	Dress clips	11.	Candle holders
2.	Bag pulls	7.	Jewelry	12.	Cigarette boxes
3.	Blind pulls	8.	Tie clasps	13.	Jewelry boxes
4.	Keychain ornaments	9.	Picture frames	14.	Bill files
5.	Letter openers	10.	Bracelets		

For further suggestions, see reference list for books containing projects.

References

* 1. Cherry, Raymond, General Plastics, 1962, McKnight & McKnight, Bloomington, Illinois.

2. Bakelite Corporation, Bakelite Plastics - Cast Resins, Bakelite Corp., 300 Madison Avenue, New York 17, N.Y.

3. Bick, Alexander F., Plastics for Fun, The Bruce Publishing Co., Milwaukee, Wisconsin.

4. Cadillac Plastic Company, How to Work with Plexiglas, Cadillac Plastic Co., 15111 Second Avenue, Detroit 3, Mich.

5. Adams, John V., Plastic Arts Crafts, D. Van Norstrand Co. Inc., Princeton, New Jersey.

6. Cope, Dwight & Dickey, Floyd, Cope's Plastics Book, 1960, Goodheart-Willcos Co. Inc., Chicago, Illinois.

7. De Wick, E.S., & Cooper, J.H., Plastic Craft, 1946, The Macmillan Co., New York, N.Y.

8. Dubois, J.H., Plastics, 1945, The American Technical Society, Chicago, Illinois.

* 9. Edwards, Lauton, Making Things of Plastic, Chas. A. Bennett Co., Peoria, Illinois.

10. Gottshall, Franklin H., Craftwork in Metal, Wood, Leather, Plastics, The Bruce Publishing Co., Milwaukee, Wis.

* 11. Groneman, Chris. H., Plastics Made Practical, The Bruce Publishing Co., Milwaukee, Wis.

12. Mansperger, Dale E. & Pepper, Carson W., Plastics Problems and Processes, International Textbook Co., Scranton, Pa.

13. Rohm & Haas Company, Working with Plexiglas, 1947, Rohm & Haas Company, Washington Square, Philadelphia 5, Pa.

* 14. Steele, Gerald L., Fiberglas Projects and Procedures, McKnight & McKnight, Bloomington, Illinois.

15. Whitehead, Art and Erickson, Berk, The Glasser's Manual, Taylor and Art, Inc., Plastics, 1710 East 12th Street, Oakland 6, California.

16. The Lionel Engineering Series, Plastics Engineering Manual, The Lionel Corporation, 15 East 26th Street, New York 10, N.Y.

17. Swanson, Plastics, McKnight and McKnight.

18. Lappin, Plastics, Projects and Techniques, McKnight & McKnight, 1965.

* Prime references.

MACHINE SHOP

Introduction

Metals are an important material to all of us. How new metals are in common use today and articles formerly made of wood are now being made of metal.

This unit will give you some knowledge of metals and how to shape and form them. It will give the student an insight into the many worthwhile careers related to metal working.

Specific Objectives

1. To develop an understanding of the use and importance of machine tools.
2. To develop the necessary skill to use basic machine shop equipment.
3. To develop the ability to plan a job in advance.
4. To learn to work safely and effectively with machine tools.

Course Content

What a student should be able to:

Do	Know
1. Take an outside measurement with calipers.	1. Kinds of measuring tools.
2. Take an inside measurement with calipers.	2. Fractions and decimal equivalents.
3. Take an outside measurement of round stock with a vernier caliper.	
4. Take measurements with a micrometer.	

Do	Know
5. Mark with machinist's ink.	
	6. Lathe operations.
7. Lubricate lathe.	7. Types of lubricating oil.
8. Mount material in chuck.	8. Types of lathe chuck.
9. Turn round stock.	9. Types of cutting tools.
10. Face stock.	10. Cutting speeds and feeds.
11. File on the lathe.	11. Types of lathe files.
12. Polish on lathe.	
13. Knurl.	13. Types and sizes of knurling tools.
14. Center drill stock.	14. Types and sizes of center drills.
15. Turn between centers.	15. Types and sizes of lathe dogs and centers.
16. Clean lathe.	
	17. Shaper operation.
18. Lubricate shaper.	
19. Mount work in chuck.	
20. Machine aluminum.	20. Types of cutting tools, cutting stroke, feed and cutting speed.
21. Clean shaper.	
22. Mount drill in chuck.	22. Drill-press operation.
23. Adjust table height.	
	24. Systems of determining drill sizes, fractional numbers and letters.
25. Adjust spindle speed.	25. Drill speeds and feeds.
26. Secure work to table.	26. What work-holding devices are available.
	27. Safety precautions.

Do	Know
28. Drill hole.	
	29. Grinder operations.
30. Sharpen a chisel.	
31. Use a grinding wheel dresser to clean and tune up a wheel.	
	32. Occupational opportunities in the metal industries.

OPTIONAL - To Be Used If Milling Machine is Available

	33. Use of milling machine. - Types - Holding devices - Cutter holders - Cutters.
34. Mill plain surface.	34. Basic operation of milling machine.
35. Mill slot.	

References

* 1. Feirer, J. L., General Metals, Prentice Hall Incorporated, 1965.

* 2. Fraser and Bedell, General Metal, Prentice Hall of Canada, 1962.

3. Krar and St. Arnand, Machine Shop Series, Benchwork, Thomas Nelson and Sons.

4. South Bend Lathe Works, How To Run a Lathe.

5. Glazener, L. R., Modern Metalwork, The Steck Company, Austin, Texas, 1954.

* Prime references.

SHEET AND BENCH METAL

Introduction

It is important for students to understand the large part that metals play in our society. They should know some of the basic methods of forming and shaping this material. This unit will bring the student into contact with the common tools used to form metal and teach him how to use them. A study of occupations related to metalworking will reveal the wide scope of this occupational area.

Specific Objectives

1. To provide the student with an opportunity to discover special aptitudes in metalworking.

2. To provide the student with an opportunity to learn to use metalworking tools safely and correctly.

3. To give the student an insight into the occupational opportunities related to metalwork.

Course Content

What the student should be able to:

Do	Know
Sheet Metal	
1. Measure with a steel rule.	1. Lay-out procedures and tools.
2. Lay out patterns on sheet metal and bar stock using the: - steel rule - steel square - scriber - dividers - trammel points - hermaprodite calipers - marking ink.	

Do	Know
	3. Identification of metals: a. iron b. aluminum c. copper d. brass.
4. Use a tinsnip.	4. Selection and care of cutting tools.
5. Use a prick punch.	5. Types of punches - solid and hollow.
6. Center punch for holes.	
7. Use a hollow punch.	
8. Cut metal with a hacksaw.	8. Use of hacksaws - frames - blades.
9. Cut metal with a cold chisel.	9. Chisels - types.
10. File surfaces and corners of metal. a. crossfile b. drawfile.	10. Files - uses, types, cuts, selection.
11. Drill holes with a hand drill.	11. Types of drills - Carbon, Highspeed.
12. Drill holes with a drill press.	12. And understand drilling by machine-speed selection, lubricator parts.
13. Countersink a hole.	13. Use and types of countersinks.
14. Make joints, lap, grooved.	14. Fastening methods.
15. Join metals with: - rivets - solder - spot welding (optional) - bolts - self-tapping screws.	
16. Form metal with a slip roll.	16. Methods of forming metal.
17. Bend sheet metal in a bar folder, or a box and pan brake.	
18. Bend sheet metal by hand.	18. Use of stakes, forming block.
19. Bend bar stock in bender.	
20. Bend bar stock by hand on anvil, bending pins and vise.	20. Types of hammers, mallets, and their use.

Do	Know
21. Twist bar stock.	21. Heat-treating colors.
22. Temper, anneal, and harden metals.	
	23. Use of vises and their care.
24. Grind a cold chisel and punch.	24. Types of grinders and wheels.
25. Thread with taps and dies.	25. Standard thread forms.
26. Paint with brush and spray.	26. Various finishing methods.
27. Polish surfaces with emery cloth, steel wool, grinding compound and buffer.	
28. Scratch finish a surface.	
29. Pun a surface.	
30. Color by heat-tinting and chemicals.	

References

* 1. Ludwig, O.A., Metalwork Technology and Practice with Study Guide General Publishing Company, 1962.

* 2. Frazer and Bedell, General Metal, Prentice Hall of Canada, 1962.

* 3. Feirer, J.L., General Metals, Prentice Hall Incorporated, 1965.

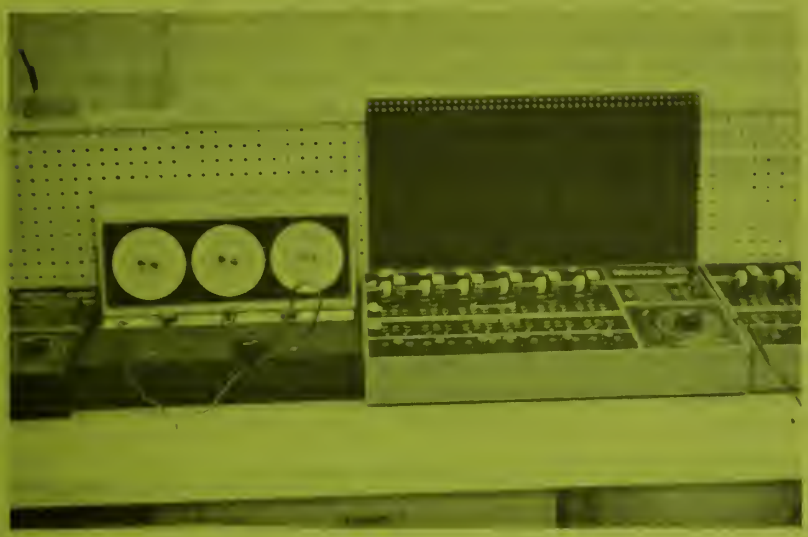
4. Wilkinson, H., Basic Sheet Metalwork, Macmillan Company, 1st. edition 1964.

5. Neundorf and Stevens, Sheet Metal Practice - Part I, McGraw-Hill 1962.

* Prime references.

THE ELECTRONIC COMPUTER

Introduction



The development of the electronic computer, the so-called "giant brain", is one of the most remarkable and important developments of this century. It may well be that the computer will eventually bring more benefit to man than any other modern invention. The first computer was built in 1946. It was slow and unsatisfactory. Since then vast improvements have been made, particularly because of the use of transistors. These improvements helped to diversify the uses of computers.

Specific Objectives

1. To develop an understanding of the basic principles of operation of the analog and digital computers.

2. To impress upon students this new and important technological field and thus guide capable students to determine if their life work might be in this field.

3. To perform a variety of mathematical operations by using computers.

4. To do simple programming on the digital computer.

5. To relate the use of electronic computers to automation, engineering, science, and other data processing.

6. To show the students another important use of electricity.

Suggested Procedure

In a multiple-activity program there would generally be from four to six students working with computers at one time. Analog computers are not as common as digital computers and therefore it is suggested that only about two weeks be spent on these. It is then possible to have only two analog computers. However, there should be one digital computer for each student. Although it is possible to have two students working on one computer, this is not advisable. Students prefer to work alone in this area.

The manuals provided with the computers are generally well written and can be used by the students without too much difficulty. However, a considerable amount of instruction is necessary in order to help students understand what they are doing. The exercises in the manuals can be supplemented by the instructor. Some program writing should be attempted so that the students can gain more knowledge of the circuit work involved. It is suggested that students should be given a short test at the end of each book so that they do not proceed to the next one unless they achieve some understanding of the material already covered. They should also be given a test at the end of their work with computers so that a profile of achievements in the various technologies covered by each student can be made at the end of the term.

Uses of Computers

1. Computers for Office Automation

Governments and business organizations can save many thousands of dollars and also conduct their business more efficiently through the use of computers.

2. Computers in Engineering

Many of the complex things man is building could never be built with any assurance of success were it not for electronic computers. Multistage rockets, nuclear reactors and many other such projects are too costly to build on an experimental basis. Mistakes made in construction of nuclear machines can be located by placing data on computers which locate errors. Rather than build a real model, an engineer can develop sets of equations to represent the performance of the real model. These equations worked out on computers show the final results quickly.

3. Computers in Science

Computers were originally built by scientists to help them to calculate rapidly and accurately. For example, astronomers spent most of their lives making calculations; now computers can do these quickly, freeing the scientist for other work.

4. Computers in Automatic Control

We already have many factories which are automatic. Computers are programmed to control the machines according to a pre-arranged plan. This type of control is more efficient than human control. The use of computers for this type of work will vastly increase in the future.

Course Content

What the student should be able to:

The Analog Computer

Do	Know
1. Study the circuit of an analog computer.	1. The principle on which analog computers operate.
2. Multiply on a computer.	2. How to multiply numbers using the computer.
3. Divide on a computer.	3. How to divide numbers using the computer.
4. Solve problems using the computer.	4. Methods of working out simple problems involving formulas in which multiplying or dividing is necessary.
	5. Some practical uses of analog computers in the world of today.

It is suggested that about two weeks be spent on this work and the balance of the time on the digital computer.

The Digital Computer

6. The exercises outlined in the computer manual to become familiar with the machine.	6. What components make up the digital computers and what purpose each component serves.
7. Program exercises given in the manual in order to learn the basic computer functions.	7. What a digital computer is. a. Basic computer functions b. Some knowledge of commercial equipment.
8. Program operations "And", "Or", "Not"; "Either" but not "Both". The experiments in the manual which make use of decision making.	8. How computers make logical decisions.
9. The experiments outlined in the manual. These are simulations of simple computer-like devices in everyday use.	9. The extent of the work computers can do.

Do	Know
10. Program and play games on a computer using it as an opponent or as a referee.	10. How computer games can be played.
11. Binary addition, subtraction, multiplication and division, using the computer.	11. How computers do arithmetic.

The content outlined is of sufficient length and difficulty to challenge the best student. He will succeed according to his ability and interest and the ability and interest the instructor displays.

References

* 1. Computer Basics, General Publishing, $5.50 each
6 volumes, 1961 Paperback $2.20 each.

2. Boschen, Computer Circuits & Projects You Can Build, General Publishing.

3. Jacobowitz, Computer Arithmetic, John F. Rider Publishing, Inc. N.Y.

* Prime reference.

INDUSTRIAL CRAFTS

Introduction

The student appeal of Industrial Crafts lies in its real life situations and the solution of practical problems. So much of education is theoretical and made up of artificial experiences that to some it becomes distasteful.

In Industrial Crafts, the student finds there are other standards of achievement than those required for mental prowess and he learns to respect these accomplishments in others.

There are four units in Industrial Crafts, namely: ceramics, leather, art metal, and lapidary. No more than two (2) of these should be chosen in the total junior high school program.

CERAMICS

Introduction

The field of ceramics is very extensive since it includes the making and processing of all industrial, commercial, and art work involving the use of clay. In ceramics, pottery has its most popular appeal when treated as a craft, and can be brought close to the commercial product by the use of plaster molds for casting.

In this course, ceramics will be regarded as the shaping or forming of clay into a finished piece of pottery. It will include treating by heat, glazing, and otherwise ornamenting of the project and all the intermediate steps required to produce a finished object of beauty and utility.

The following course may be approached from the creative or craft aspect or from the industrial point of view. Either approach gives a feeling of satisfaction to the student since the results are equally gratifying, and acquaints the student with possibilities for jobs in the manufacturing of ceramics.

Pottery clay from local sources may be used but more uniform results with less disappointments will be experienced if the clay is purchased in a prepared state. Clay may be purchased in a moist state or in powdered form, known as clay flour. The powdered form is recommended since it is not necessary to pay freight charges on water which can be added locally.

Specific Objectives for the Ceramics Area are:

1. To give an appreciation for ceramics as used in modern homes and living as well as in industry.

2. To acquaint the student with some of the basic experiences in handling clay and glazes.

3. To develop appreciation for good design and workmanship in ceramics.

4. To acquaint the student with the various forms of ceramics as used in the home and commercially.

5. To stimulate interest in ceramics as a hobby or leisure time interest as well as a commercial interest.

Course Content

What the student should be able to:

Do	Know
1. Prepare day by wedging.	1. How to fettle greenware.
	2. Purpose of wedging board.
3. Mold a free-form shape in clay.	3. Methods of finishing greenware.
4. Form clay by the ball method.	4. Application of ball-type project.
5. Form clay by the slab method.	5. Application of slab-type project.
	6. Advantages and disadvantages of slab-type work.
7. Form clay by the coil method.	7. Application of coil method.
8. Use the potter's wheel for simple turning.	
9. Finish greenware.	
10. Fire bisque ware.	
11. Apply various glazes.	11. Different ways of applying glazes.
12. Apply over glazes.	
13. Apply under glazes.	
14. Fire glazeware.	
15. Make plaster bats.	15. Purpose of plaster bats.
	16. Storing of materials.
17. Make casting slip.	17. The proper consistency of slip for pouring.
18. Make greenware from slip.	

Do	Know
19. Make one-piece molds.	
20. Make simple two-piece molds.	
21. Mix plaster of paris for molds.	21. Methods of preparing plaster for molds.
	22. What greenware is.
	23. History and uses of commercial ceramics.

Suggested Projects

1. Bowls
2. Small vases
3. Shallow dishes
4. Salt and pepper shakers
5. Spoon trays
6. Candy dishes
7. Sugar and creamers
8. Figurines
9. Novelties
10. Free-form dishes.

References

* 1. Thompson, Seeley, Activities in Ceramics.
Excellent student text with general information and techniques. Free-forming, press-forming and build-up methods are outlined as well as slip casting and the potter's wheel. Glazing, decorating, firing and mold making covered.

2. Ickis, Marguerite, Arts and Crafts.
Section of pottery. Suggestions for homemade equipment. Simple clay construction methods and casting.

3. Shore, Louis A., Arts and Crafts for Canadian Schools.
Historical notes. Simple pottery procedures and slip casting.

4. Hyman, Richard M., Ceramics Handbook.
Covers all the basic ceramic processes. Many illustrations of commercial equipment and directions for making your own equipment.

5. De Sager, Walter A., Making Pottery.
Good introduction to history of pottery. Picture examples of different types of early ware. Instructional part based on "seeing". Each step and process pictured with short explanations.

6. Thomas, John & Sikes, Mary, Pottery and its Making.
Good information book. Excellent on history of pottery among early nations. Deals with modern manufacturing methods from informational standpoint.

7. Olson, Delmar W., Pottery, Getting Started in Ceramics.
   Complete book for beginners. How to design, form clay by hand or on the wheel, glaze and decorate. How to fire your own ware and make molds. Where to purchase supplies. Chapter on equipment planning.

8. Dougherty, John, Pottery Made Easy.
   Clearly written, easy to follow book covering all essentials and processes that are taught in school ceramics. Each process divided into operations with each step numbered. Well illustrated.

9. Johnson, W.H. & Newkirk, Louis V., The Ceramic Arts.
   Very comprehensive book written for use in industrial arts classes. Besides the truly ceramic fields, it includes chapters on alabaster, cement, plastics, and concrete. Very well illustrated. Contains many projects, plans, and ideas.

10. Binns, C.F., The Potter's Craft.
    Good on the history, nature and preparation of clay. Covers the potter's wheel, turning and mold making as well as casting, glazing, and firing of clay with a chapter on high-temperature wares.

* 11. Mitchell, Ceramics Stone Age to Space Age, National Science Teachers Association, 1201 - 16 Street N.W., Washington 6, D.C., 1963 - 50¢.

* Prime references.

LEATHER

Introduction

Because of decreasing working hours per week, we find ourselves with an increasing amount of spare time per week which can, pleasantly and sometimes profitably, be spent in the development of hobbies and leisure time interests.

To acquaint the student with some of these areas and the possibilities that they offer in the hobby and leisure time field, it is suggested that he be exposed to at least one of the following areas while taking exploratory subjects in the junior high school. It is for this reason that this guide is set up to cover industrial crafts areas that are not touched upon as often as others.

With this in mind the following objectives have been set up specifically for the Industrial Crafts area of industrial arts.

Specific Objectives

1. To familiarize the student with some of the fundamental processes and constructions as used in this media.

2. To develop an appreciation of good design and workmanship as displayed in this media.

Course Content

What the student should be able to:

Do	Know
1. Store, sharpen, and condition tools.	1. Care of tools.
2. Make templates.	
3. Lay out and cut leather.	3. Methods used for laying out and cutting leather.
4. Moisten leather.	4. Preparation of leather for tooling or carving.
5. Transfer designs to leather.	5. Various ways in which to transfer designs to leather.
6. Use Craftaids.	
7. Use swivel knife.	7. Methods of using swivel knife.

Do	Know
8. Tool sequences: a. cutting b. reveling c. background.	8. The proper tool sequences.
9. Set stamping.	
10. Use edge creaser.	10. Ways to finish edges properly.
11. Skive leather.	11. The purpose of skiving.
12. Lace using: a. whip stitch b. single buttonhole c. double buttonhole.	12. Types of lacing.
13. Wet or dry splicing.	13. Two methods of joining lace.
14. Sew leather.	14. Hand sewing of leather.
15. Cement leather.	15. Current methods of cementing.
16. Use leather punch to make holes.	16. Types of leather punches.
17. Fasten with various fasteners: a. eyelets b. rivets c. snap fasteners.	
18. Finish with a. hand rubbing b. liquid wax c. paste wax d. oil.	18. Application of finishes.
	19. Correct care of leather articles.
20. Assemble leather projects properly.	
21. Clean leather articles.	
22. Obtain literature from Department of Industry and Development, 335 Highways Building, Edmonton, on leather Industries in Alberta.	22. Leather industries of Alberta.
	23. Occupational and leisure time opportunities related to leather work.

Suggested Projects

1. Book marks
2. Comb cases
3. Key cases
4. Wallets or billfolds
5. Ladies' wallets
6. Luggage tags
7. Eye glass cases
8. Knife sheath
9. Axe sheath
10. Book covers
11. Bond cases
12. Pocket secretaries
13. Coin purses
14. Belts of various styles
15. Checkbook covers
16. Small bags or purses.

Four projects should be selected by the teacher. The parts of the project can be cut out oversize and placed in an envelope. The student thus has all the parts and can begin work immediately. The student cuts out the pieces to exact size and puts on his own design.

References

* 1. Cherry-Raymond, General Leathercraft, 1962, General Publishers.

2. Zimmerman, Leathercraft, Goodheart-Willcox Co., Inc.

3. Groneman, Leathercraft, Charles A. Bennett Co., Inc.

4. Lucky Seven Foto Carve Book by Craftool Co.

5. Grik, Leathercraft, Book One.

6. Grik, Leathercraft, Book Two.

7. Grik, Leathercraft, Book Three.

8. Al. Stahlman, How To Carve Leather.

* Prime reference.

ART METAL

Introduction

Art metal work is one of the oldest forms of metal working. Ancient peoples knew how to work with gold, copper, bronze, silver, and pewter, and made beautiful articles from them. Today making articles from non-ferrous metals is an interesting and rewarding experience.

This unit in art metalwork allows considerable scope in the selection and design of projects. Opportunities are provided for the pupils to use their initiative, experiment, and express creativeness. It will help develop a sense of pride in individual accomplishment.

Specific Objectives

1. To provide an opportunity for the expression of originality and individual initiative.
2. To provide an opportunity to apply the principles of good design to metal.
3. To develop enough skill to complete a satisfactory project.

Course Content

What the student should be able to:

Do	Know
	1. The basic principles of good design.
2. Lay out a project using: a. steel rule b. square c. scriber d. dividers.	2. The use of layout tools.
3. Transfer a design to metal using: a. tinplate b. carbon paper.	3. How to transfer designs to metal.
4. Use tinsnips to cut metal.	4. Methods of cutting metal.
5. Use jeweler's saw.	
6. Use cold chisel.	
7. Use wire cutters.	

Do	Know
8. Use a hand drill to make holes.	8. Methods of making holes.
9. Use hollow punches.	
10. Anneal aluminum.	10. Methods of annealing and pickling art metals.
11. Pickle copper.	
12. Bend metal with: a. stakes and mallet b. metal brake.	12. Methods of forming art metals.
13. Twist bar stock on forms and jigs.	13. Twisting methods.
	14. Types of stakes.
	15. Types of hammers used in forming sheet metal.
16. Form metal by beating down.	
17. Form metal by raising.	
18. Finish edges of metal by: a. flaring b. fleeting c. doming d. crimping e. peening.	18. Methods of finishing edges.
19. Decorate metal by: a. planishing b. fleeting c. chasing d. spotting e. stamping f. stipling g. embossing.	19. Methods of decorating metal.
20. Use emery cloth, steel wool, and buffing compounds to polish and clean metal.	20. Polishing methods.

References

* 1. Siegner, C. Vernon, Art Metals (1961), General Publishing Company.

2. Fraser-Bedell, General Metal, (1962), Prentice-hall Company of Canada.

* Prime reference.

LAPIDARY

Introduction

Records indicate that man practiced lapidary as early as 5,000 B.C. when the Egyptian Pharoahs used polished rock as ornaments and for ring seals. The Chinese have long been famous for their jade carvings. Many countries are noted for their precious stones which are used in lapidary work. India has rubies, Australia has opal, and Brazil has agate.

Lapidary can be enjoyed by people of all ages and of both sexes. It is a healthful, relaxing hobby which can involve a lot of varied activity. This includes reading interesting books, making field trips for rock collection, attending rock shows, meeting dozens of people who are also rockhounds and spending many happy hours working with nature's gift of rock and gem material while converting them into objects of usefulness and adornment.

The invention of the diamond-saw blade, improved abrasives and polishing compounds have resulted in a finer finished product which can be completed in record time. The reduced cost of equipment and improved techniques make it possible for an ever increasing number of people to enjoy the art of lapidary.

Specific Objectives

1. To develop an appreciation of the beauty of nature.
2. To foster an appreciation for fine craftsmanship.
3. To develop manipulative skill.
4. To teach identification of some rocks and minerals.
5. To learn different techniques for polishing rock material.
6. To develop originality in design and pride in accomplishment.
7. To explore a wide avenue which could become a very interesting and satisfying hobby.

Course Content

What the student should be able to:

Do	Know
1. Test rock for hardness using Moh's scale.	1. What makes rocks suitable for polishing and cutting: a. hardness b. color c. pattern d. fracture.

Do	Know
2. a. cabachon grinding b. flat lapping c. tumbling d. faceting.	2. Techniques of polishing and cutting.
3. Cut with combination slab and trim saw.	3. Names and functions of machines.
	4. Proper care of blade.
	5. Use of lubricant.
6. Grind rock to shape.	6. Proper speeds, grit sizes.
	7. Proper care of wheels.
8. Sand and polish stone by machine.	8. Types of sanding discs and belts (wet or dry).
	9. Abrasives.
10. Use a template.	
11. Use a dop stick.	
12. Remove dop stick, clean and fit stone.	
13. Polish rock using cerium oxide and: a. felt b. leather c. muslin d. pellon.	13. Polishing methods.
14. Glue stone to finding.	14. Use and kinds of glue, e.g. Epoxy 220 glue.
15. Horizontal lap.	
16. Polish by tumbling.	
17. Faceting.	17. Special technique for fancy ring stones.
18. Search for suitable rocks.	18. Rock hunting areas.

Vocabulary

Lapidary - the art of cutting and polishing rocks.
Lapidarist - one who cuts and polishes rocks.
Rough - rock and gem material as it is found deposited by nature.

Slab - rough material is sawed into slabs, usually about 3/16" thick.
Cabachon - rock is usually ground into this shape for making jewellry; a gently rounded surface with the crown thicker than the edges.
Baroque - a rock of irregular shape, usually polished in a tumbler.
- Baroques may be mounted on key chains, bracelets, etc.
Dop Stick- small dowell or nail cemented to preformed rock to enable easier manipulation of rock for grinding, sanding, and polishing operations.
Rockhound- one who is actively interested in collecting rocks.
Pebble puppy - a young rockhound.

Suggested Projects

1. Earring and pendant sets
2. Rings
3. Cuff link and tie bar sets
4. Brooches
5. Bracelets
6. Key chains
7. Pen stands
8. Bookends.

References

* 1. Sinkankas, Gem Cutting, A Lapidary's Manual, D. Van Norstrand Co., Inc., Princeton, New Jersey, $13.00.

** 2. O'Brien, How to Cut Gems, 1116 North Wilcox Avenue, Hollywood 38, California, $1.10.

3. H. C. Dake, The Agate Book, Minerologist Publishing Co., Portland 14, Oregon, $1.50.

4. Dr. H. C. Dake, The Art of Gem Cutting, Minerologist Publishing Co., Portland 14, Oregon, $2.00.

5. Gem Tumbling and Baroque Jewellery Making, Victor Agate Shop, South 1709 Street, Spokane, Washington, $2.00.

6. Lelande Quick and Hugh Leiper, Gemcraft, Chilton Co., Philadelphia, $7.50.

7. Richard M. Pearl, How to Know the Minerals and Rocks, Signet Key Book, $1.00.

8. Rocks and Minerals, A Golden Nature Guide, $1.35.

* Gemcutter's "bible"
** Excellent condensation.

Magazines

1. The Lapidary Journal - Box 518, Del Mar, California.

2. Gems and Minerals - Mentone, California.

3. Rocks and Minerals - Box 29, Peekskill, New York.

Sources of Supply

Machinery - Pioneer Lapidary Equipment
513 - 8 Avenue, S. W. CALGARY, Alberta.

Green's Rock and Lapidary,
916 Centre Street, N. CALGARY, Alberta

Canadian Lapidary Supply,
612 MacLean Block,
CALGARY, Alberta.

These two dealers handle other supplies as well.

Mr. Arthur McMartin, 46 Westminster Drive, Calgary, has given instruction in identification and classification of rocks and also teaches courses in cutting and polishing. He would be willing to assist anyone who wishes to make inquiry.

APPENDIX

INSTRUCTION SHEETS

Introduction

Instruction sheets have great value in providing information to the learner when he needs it. The sheets free the teacher from having to answer for each individual the numerous questions that arise in the process of doing an operation or job.

The sheets can be used on the job or as a reference for assignments at home or in the library whenever new operations, jobs or information is presented.

References

1. Silvius, H.G., and Bohn, R.C., Organizing Course Materials, McKnight and McKnight, 1961.

2. Newkirk, L. V., Organizing and Teaching the General Shop, The Manual Arts Press, Peoria, Ill. 1947.

3. Weaver, G. G., Shop Organization and Management, Pitman Pub. Corp., Toronto. 1959.

4. Fryklund, V.C., Analysis Technique for Instructors, Bruce Pub. Co., 1956.

Tools and Equipment Needed

Writing and drawing supplies.

Types of Instruction Sheets

Instruction sheets are written teaching aids which contain organized material for the use of individual students. There are four common types:

(a) Operation Sheet

This sheet gives definite step by step instructions for performing an operation. These may include the performance of a single operation on a machine such as dadoing on the circular saw, or drilling with the press drill. The objective is to discuss each of the steps in the operation in sufficiently complete form that it may be readily understood by the reader. Sketches and photographs are often used as illustrations to make a step even more understandable.

(b) Job Sheet

A job sheet is a statement that gives directions on how to do, completely and in proper sequence, a number of operations. The procedure for making a project or doing an experiment would constitute a job sheet. It includes the job specification, a list of tools and materials, questions, references and a series of step-by-step directions for doing the job.

A student should occasionally be required to make a job sheet in order to develop skills in attacking a new problem.

(c) Information Sheet

Information sheets are written by teachers to cover the independent topics involved.

The content consists of statements that are kept simple but include the facts without unnecessary detail.

Information sheets may be written for three categories, technical, general, or guidance.

(d) Assignment Sheet

The assignment sheet is used to direct the activity of the student in study or investigation. The assignment sheet may include assignments of problems that are offered for application of the principle under instruction or in another form a list of questions covering the topic for investigation is presented. Directions are given telling how to find the answers.

MAKING AN OPERATION SHEET

Introduction

Operation sheets are used to give step by step instructions in performing an operation. They are used when students must repeat operations when not under the direct supervision of the teacher.

References

Silvius and Curry, Teaching the Multiple Activities, McKnight and McKnight Pub. Co.

Tools and Equipment

Writing and drawing equipment.

Procedure

1. Select the title of the operation.
2. Select and read references based on the title.
3. Determine the objective(s) you want to accomplish.
4. Analyze the operation into simple, sequential steps (do this on scratch paper).
5. Perform the steps of the operation as you have it outlined.
6. Write an introductory statement giving the importance of the operation, its use and applications.
7. List the references the student could use for further information.
8. List the tools required to perform the operation.
9. Under the title procedure, list the steps required to do the operations taken from your analysis. (4)
10. Illustrate with diagrams or photographs steps that need greater clarity.
11. Develop questions to evaluate the students understanding of the operation.
12. Follow the format outlined below for laying out the operation sheet.

TITLE OF OPERATION

I. INTRODUCTORY STATEMENT

II. REFERENCES

III. TOOLS AND EQUIPMENT NEEDED

IV. PROCEDURE

V. EVALUATION

MAKING AN INFORMATION SHEET

Introduction

Information sheets are used to reinforce instruction given by the teacher by lecture or demonstration. They provide the student with reference material based on related information concerning the technical, general or guidance aspects of the topic.

References

Silvius and Bohn, Organizing Course Materials For Industrial Arts, McKnight and McKnight, 1961.

Tools and Equipment

Writing and drawing equipment.

Procedure

1. Select the information topic.
2. Select and read several references related to the topic. Try to obtain the latest information.
3. Make an outline of the topic and fill in pertinent material.
4. Keep statements simple and to the point. Include the facts but not unnecessary detail.
5. Develop a series of questions based on the information given.
6. Follow the format outlined below for laying out the information sheet.

TITLE OF INFORMATION SHEET

I. INTRODUCTION

II. REFERENCES

III. CONTENT

IV. QUESTIONS

MAKING A JOB SHEET

Introduction

The job sheet lists in sequential order the operations required to do a particular job. This serves as a guide to the student in his progress from step to step through the project. This is especially important if the job spans a number of shop periods.

References

Fryklund, V.C., Analysis Technique For Instructors, Bruce Publishing Co., 1956.

Tools and Equipment

Writing and drawing materials.

Procedure

1. Select the title of the job.
2. Select and read references based on the job.
3. Analyze the steps of procedure and arrange them in sequential order.
4. Make a trial run of the steps and make corrections.
5. Write an introductory statement giving the reason for the job, its use and applications.
6. List the references the student could use for further information.
7. List the tools and equipment required to complete the job.
8. List the steps in the procedure to perform the job.
9. Illustrate with diagrams or photographs the steps that need further clarification.
10. List some questions based on the job sheet, to determine the student's understanding of the operations involved.
11. Follow the format given for laying out other instruction sheets.

TITLE OF OPERATION

I. INTRODUCTORY STATEMENT

II. REFERENCES

III. TOOLS AND EQUIPMENT NEEDED

IV. PROCEDURE

V. EVALUATION

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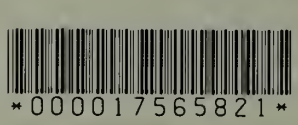

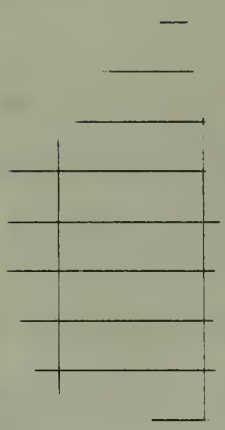

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